FIG. 1

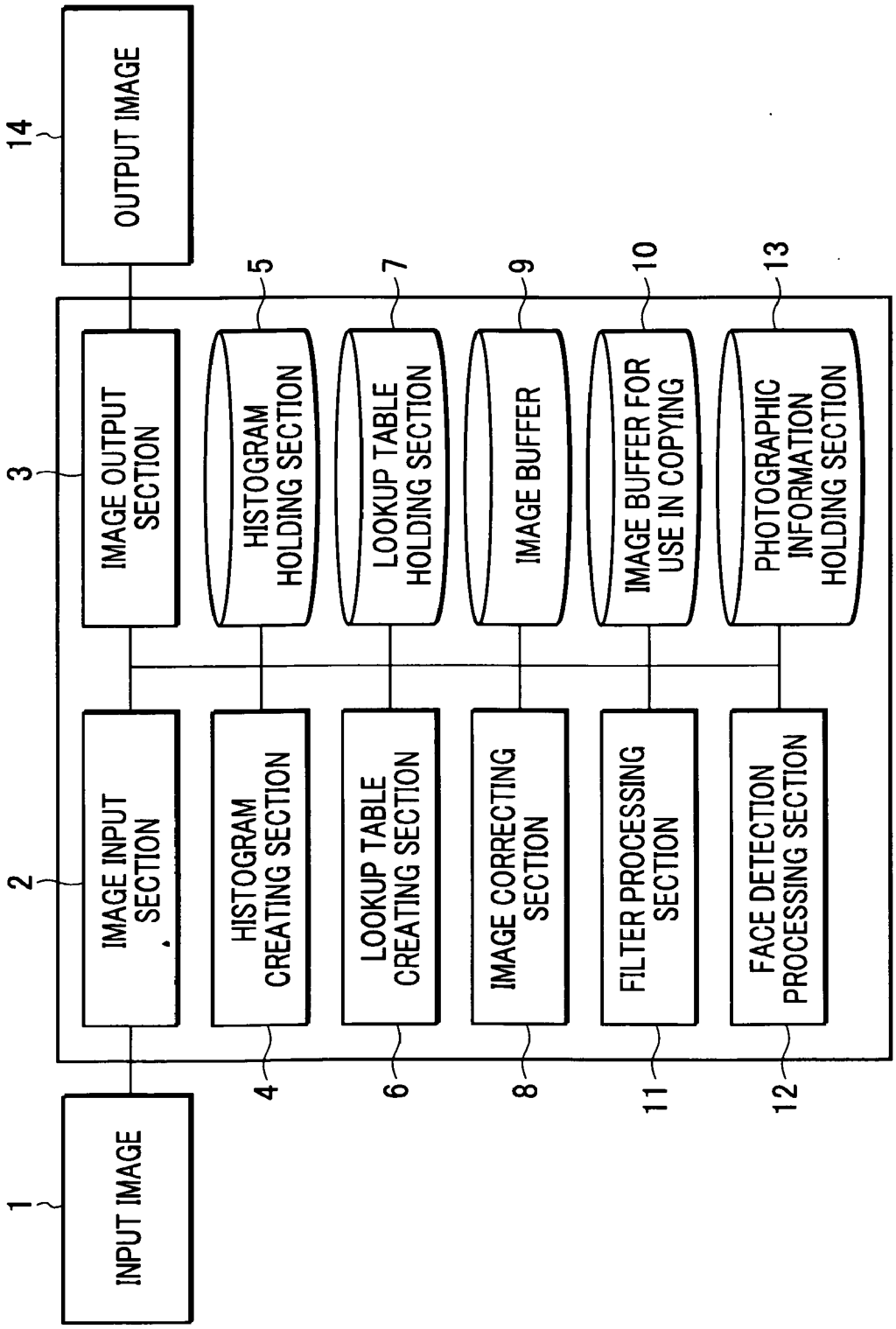

INPUT IMAGE
1
IMAGE INPUT SECTION
2
IMAGE OUTPUT SECTION
3
HISTOGRAM CREATING SECTION
4
HISTOGRAM HOLDING SECTION
5
LOOKUP TABLE CREATING SECTION
6
LOOKUP TABLE HOLDING SECTION
7
IMAGE CORRECTING SECTION
8
IMAGE BUFFER
9
FILTER PROCESSING SECTION
11
IMAGE BUFFER FOR USE IN COPYING
10
FACE DETECTION PROCESSING SECTION
12
PHOTOGRAPHIC INFORMATION HOLDING SECTION
13
OUTPUT IMAGE
14

FIG. 2

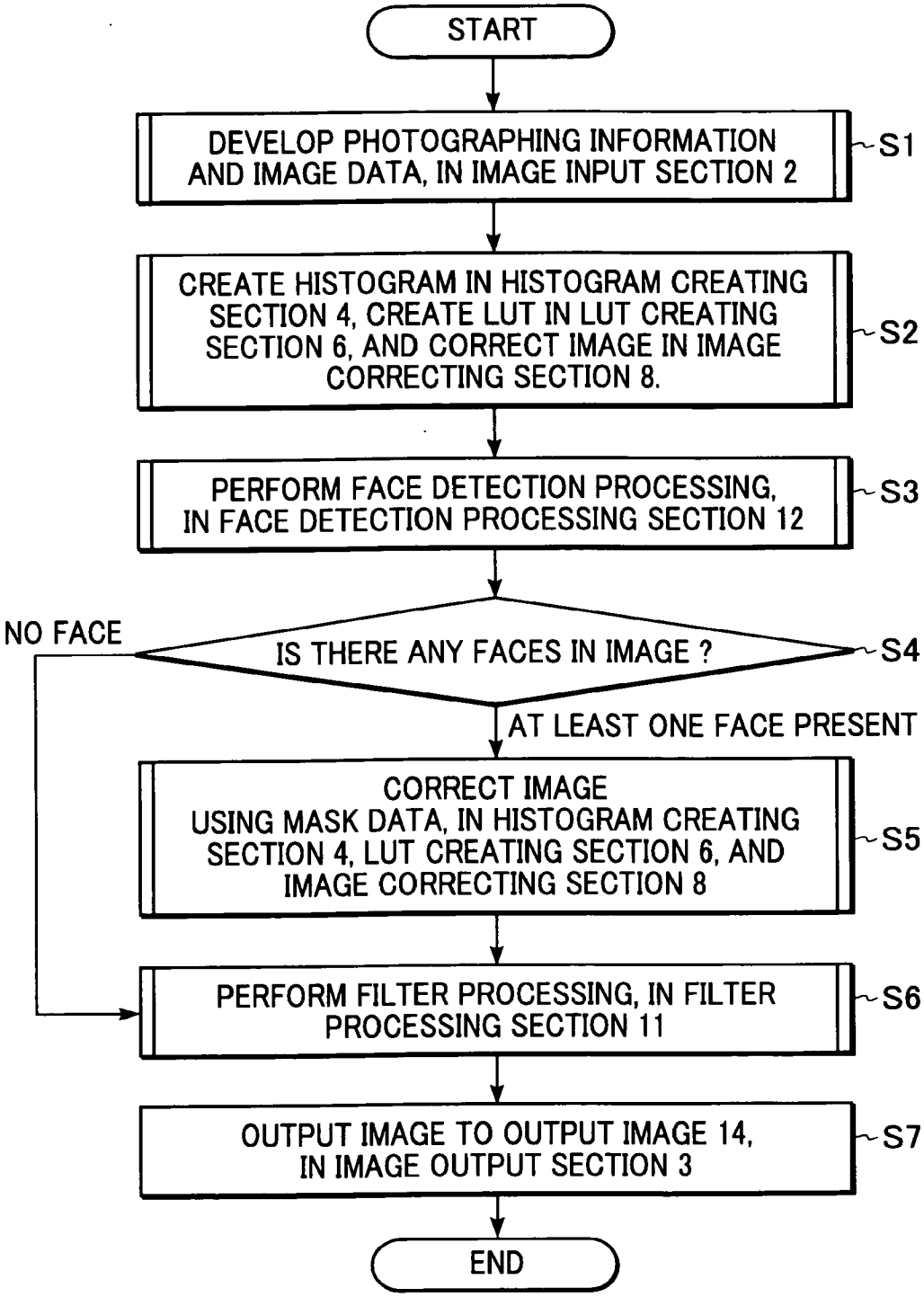

START
DEVELOP PHOTOGRAPHING INFORMATION AND IMAGE DATA, IN IMAGE INPUT SECTION 2
S1
CREATE HISTOGRAM IN HISTOGRAM CREATING SECTION 4, CREATE LUT IN LUT CREATING SECTION 6, AND CORRECT IMAGE IN IMAGE CORRECTING SECTION 8.
S2
PERFORM FACE DETECTION PROCESSING, IN FACE DETECTION PROCESSING SECTION 12
S3
NO FACE
IS THERE ANY FACES IN IMAGE ?
S4
AT LEAST ONE FACE PRESENT
CORRECT IMAGE USING MASK DATA, IN HISTOGRAM CREATING SECTION 4, LUT CREATING SECTION 6, AND IMAGE CORRECTING SECTION 8
S5
PERFORM FILTER PROCESSING, IN FILTER PROCESSING SECTION 11
S6
OUTPUT IMAGE TO OUTPUT IMAGE 14, IN IMAGE OUTPUT SECTION 3
S7
END

FIG. 3

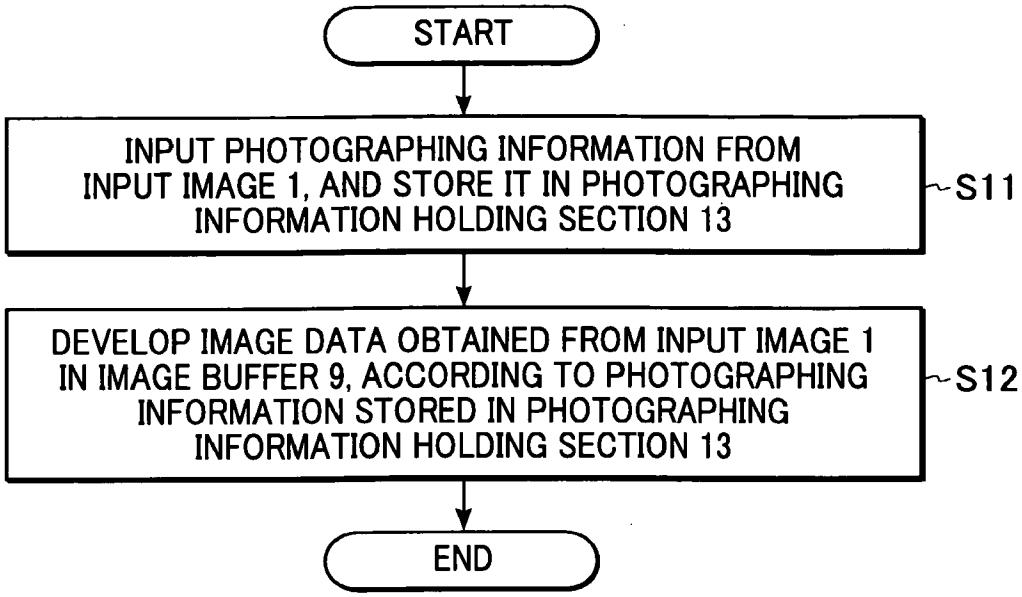

START
INPUT PHOTOGRAPHING INFORMATION FROM INPUT IMAGE 1, AND STORE IT IN PHOTOGRAPHING INFORMATION HOLDING SECTION 13
S11
DEVELOP IMAGE DATA OBTAINED FROM INPUT IMAGE 1 IN IMAGE BUFFER 9, ACCORDING TO PHOTOGRAPHING INFORMATION STORED IN PHOTOGRAPHING INFORMATION HOLDING SECTION 13
S12
END

FIG. 4

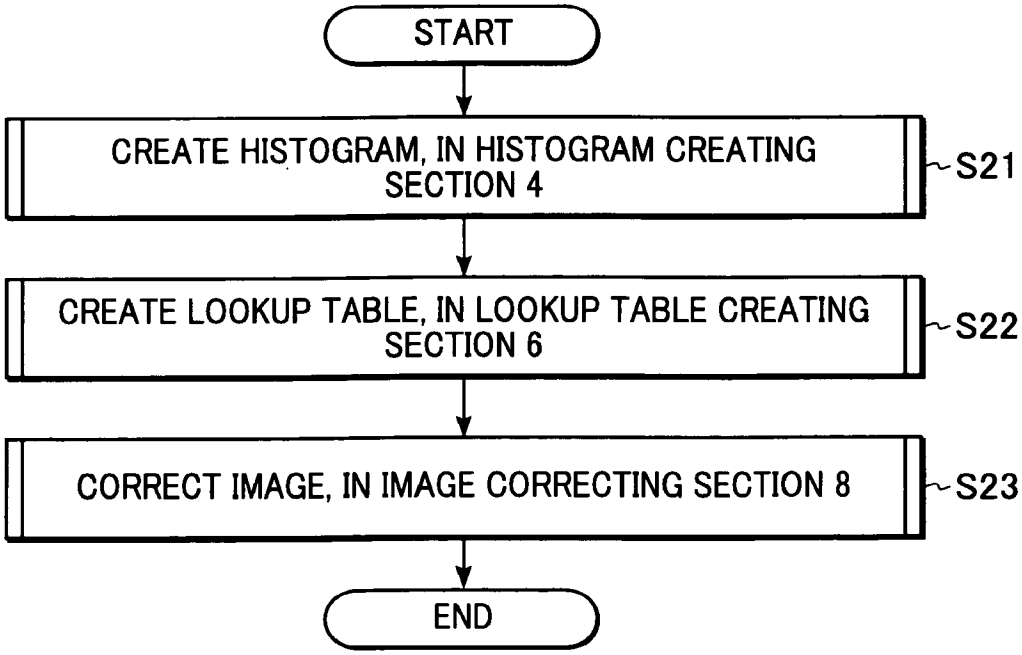

START
CREATE HISTOGRAM, IN HISTOGRAM CREATING SECTION 4
S21
CREATE LOOKUP TABLE, IN LOOKUP TABLE CREATING SECTION 6
S22
CORRECT IMAGE, IN IMAGE CORRECTING SECTION 8
S23
END

FIG. 5

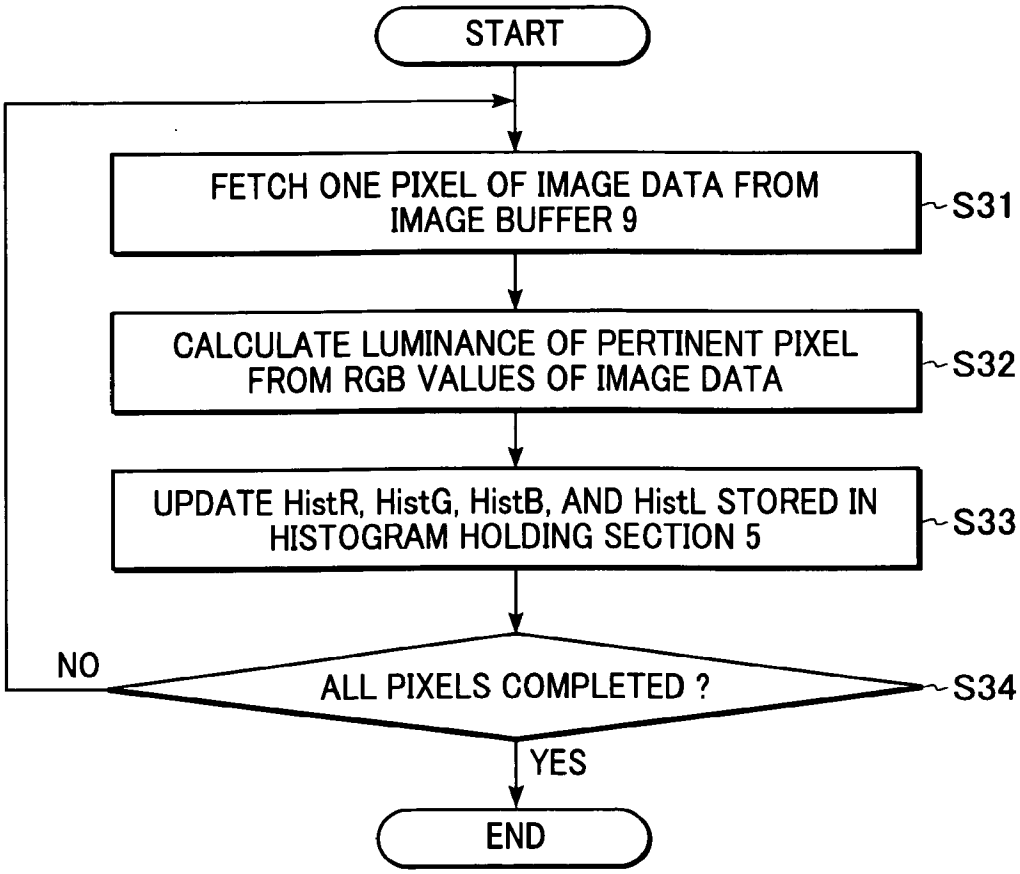

START
FETCH ONE PIXEL OF IMAGE DATA FROM IMAGE BUFFER 9
S31
CALCULATE LUMINANCE OF PERTINENT PIXEL FROM RGB VALUES OF IMAGE DATA
S32
UPDATE HistR, HistG, HistB, AND HistL STORED IN HISTOGRAM HOLDING SECTION 5
S33
NO
ALL PIXELS COMPLETED ?
S34
YES
END

FIG. 6

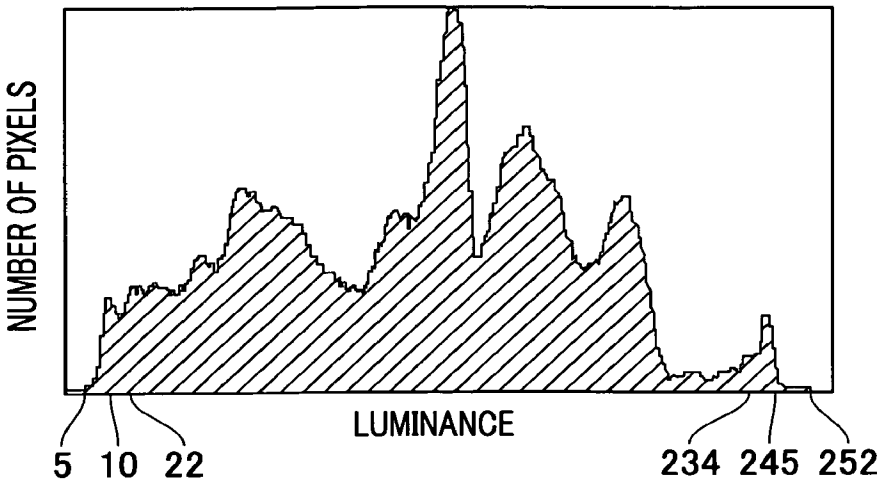


FIG. 7

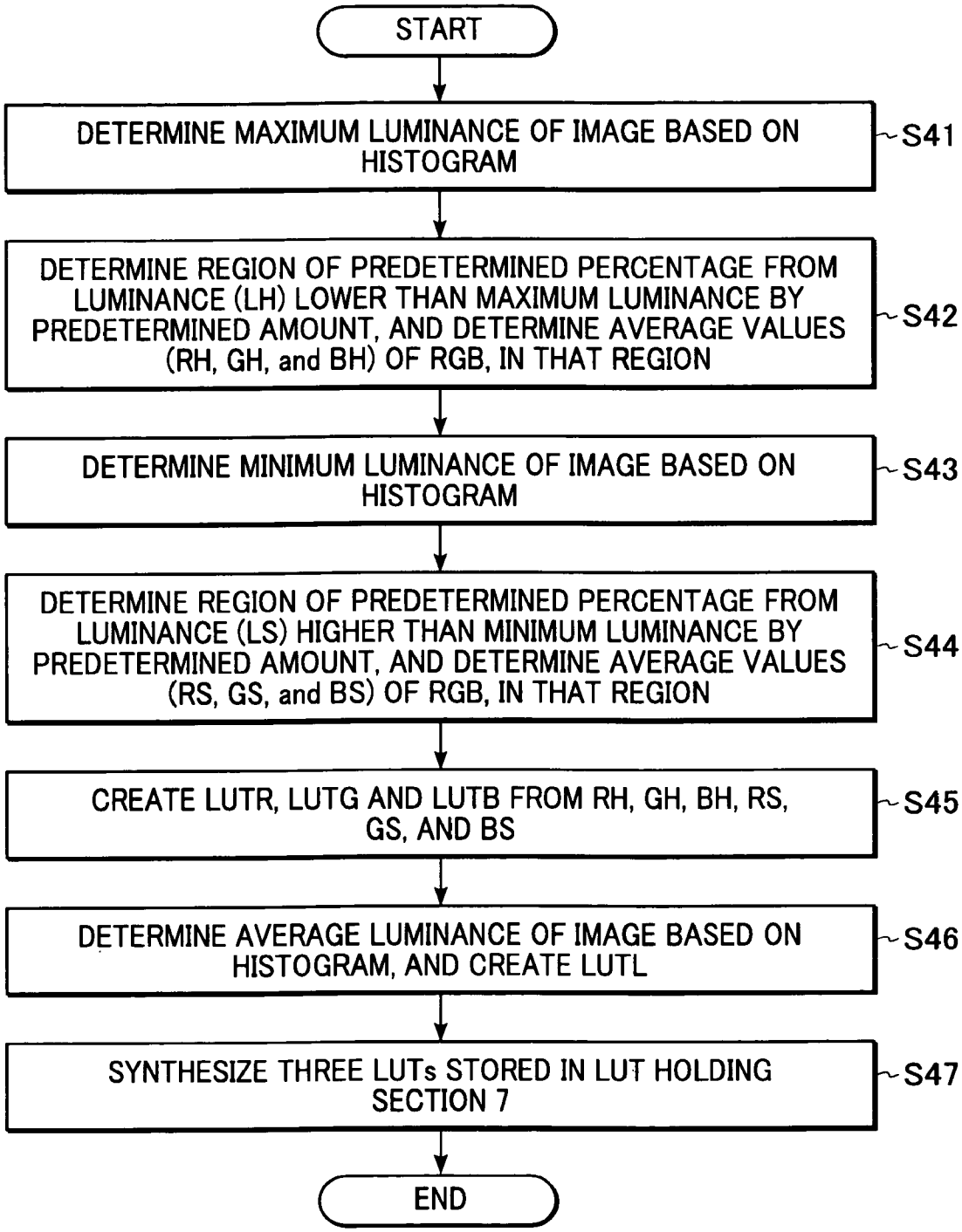
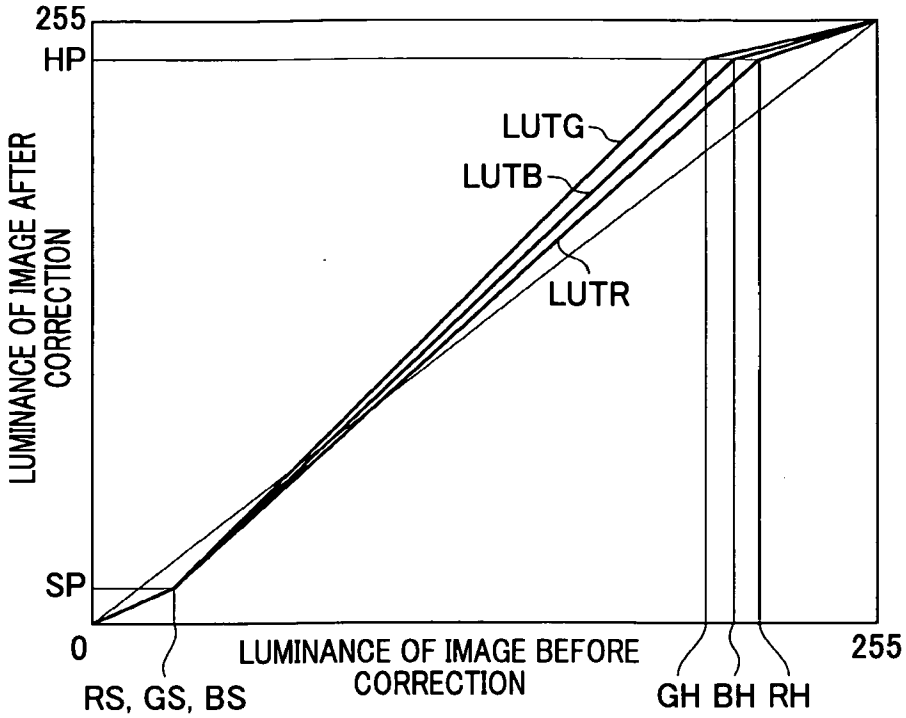
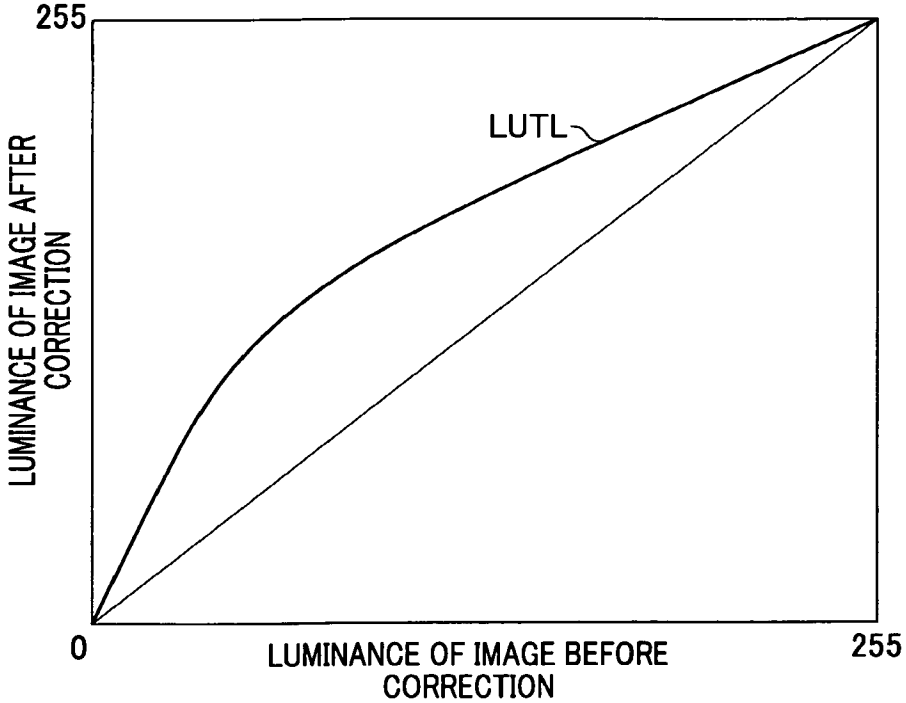

START
DETERMINE MAXIMUM LUMINANCE OF IMAGE BASED ON HISTOGRAM
S41
DETERMINE REGION OF PREDETERMINED PERCENTAGE FROM LUMINANCE (LH) LOWER THAN MAXIMUM LUMINANCE BY PREDETERMINED AMOUNT, AND DETERMINE AVERAGE VALUES (RH, GH, and BH) OF RGB, IN THAT REGION
S42
DETERMINE MINIMUM LUMINANCE OF IMAGE BASED ON HISTOGRAM
S43
DETERMINE REGION OF PREDETERMINED PERCENTAGE FROM LUMINANCE (LS) HIGHER THAN MINIMUM LUMINANCE BY PREDETERMINED AMOUNT, AND DETERMINE AVERAGE VALUES (RS, GS, and BS) OF RGB, IN THAT REGION
S44
CREATE LUTR, LUTG AND LUTB FROM RH, GH, BH, RS, GS, AND BS
S45
DETERMINE AVERAGE LUMINANCE OF IMAGE BASED ON HISTOGRAM, AND CREATE LUTL
S46
SYNTHESIZE THREE LUTs STORED IN LUT HOLDING SECTION 7
S47
END

FIG. 8A



LUTs FOR COLOR FOGGING CORRECTION AND CONTRAST CORRECTION

FIG. 8B



LUT FOR EXPOSURE CORRECTION

FIG. 9

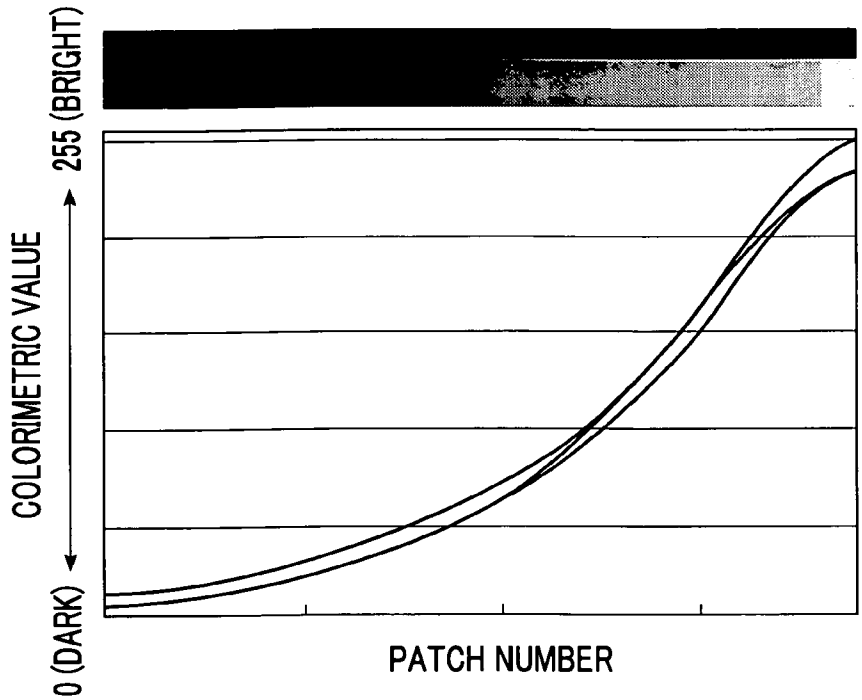


FIG. 10

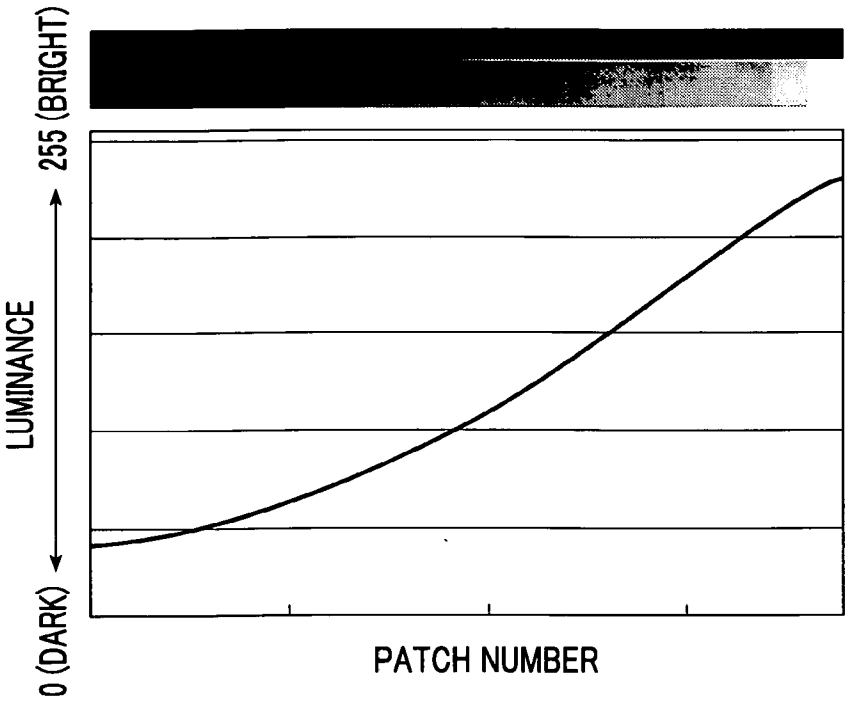


FIG. 11

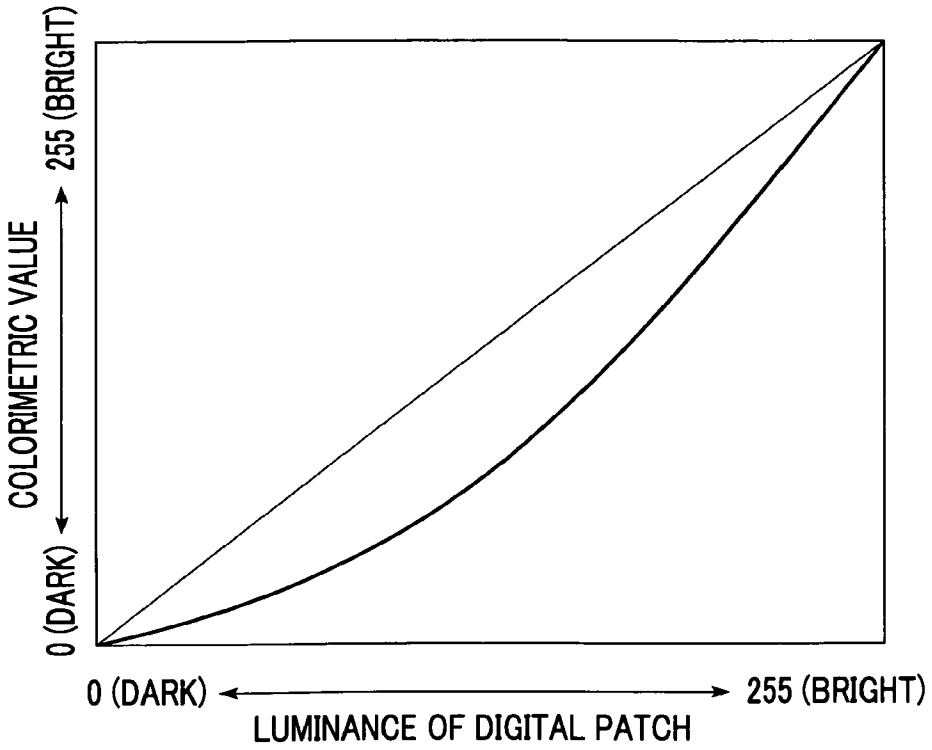

255 (BRIGHT)
COLORIMETRIC VALUE
0 (DARK)
0 (DARK)
255 (BRIGHT)
LUMINANCE OF DIGITAL PATCH

FIG. 12

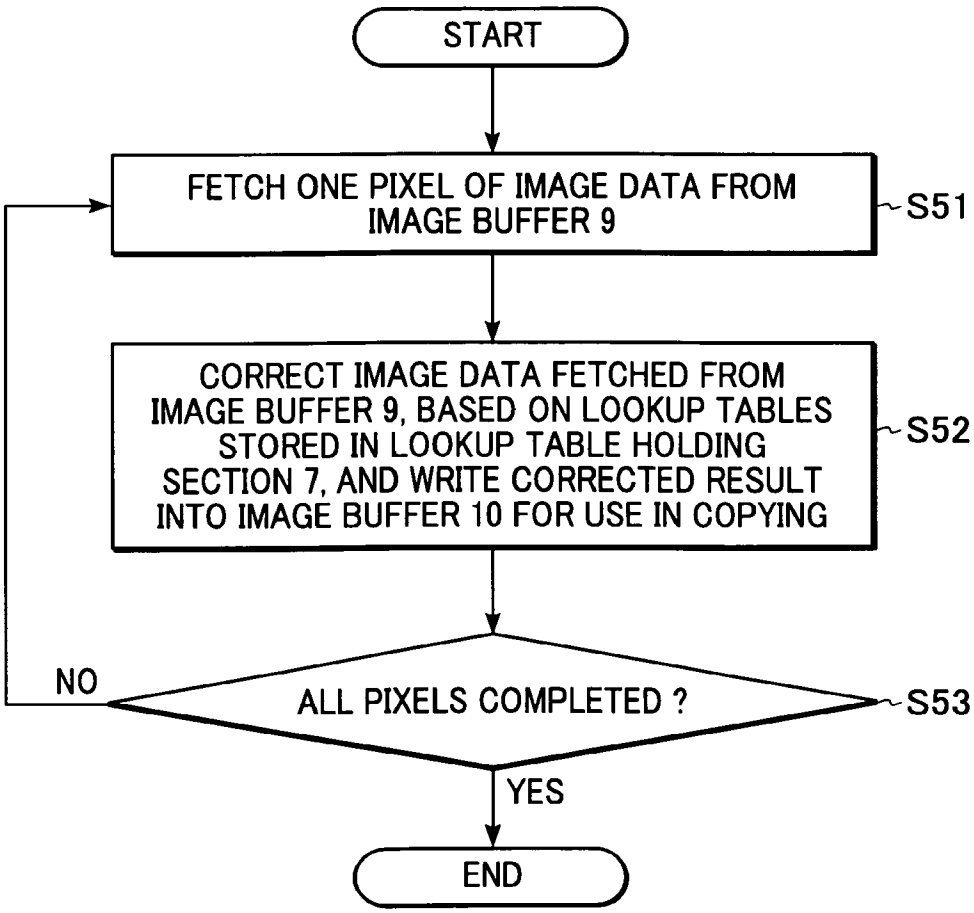

START
FETCH ONE PIXEL OF IMAGE DATA FROM IMAGE BUFFER 9
S51
CORRECT IMAGE DATA FETCHED FROM IMAGE BUFFER 9, BASED ON LOOKUP TABLES STORED IN LOOKUP TABLE HOLDING SECTION 7, AND WRITE CORRECTED RESULT INTO IMAGE BUFFER 10 FOR USE IN COPYING
S52
ALL PIXELS COMPLETED ?
S53
NO
YES
END

FIG. 13

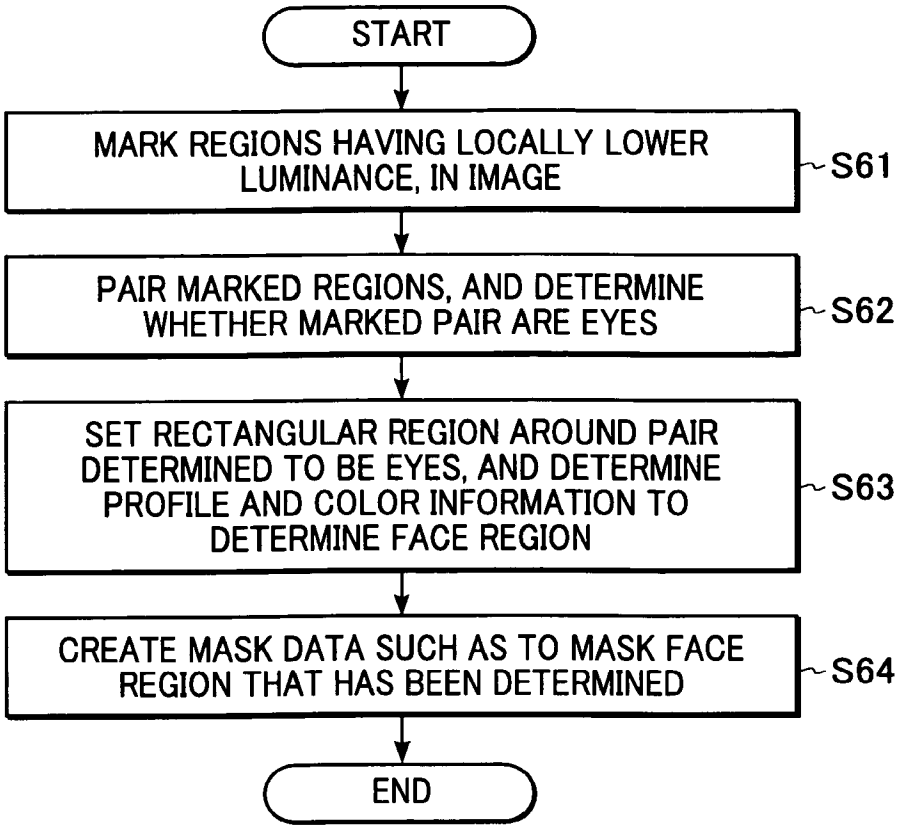

START
MARK REGIONS HAVING LOCALLY LOWER LUMINANCE, IN IMAGE
S61
PAIR MARKED REGIONS, AND DETERMINE WHETHER MARKED PAIR ARE EYES
S62
SET RECTANGULAR REGION AROUND PAIR DETERMINED TO BE EYES, AND DETERMINE PROFILE AND COLOR INFORMATION TO DETERMINE FACE REGION
S63
CREATE MASK DATA SUCH AS TO MASK FACE REGION THAT HAS BEEN DETERMINED
S64
END

FIG. 14

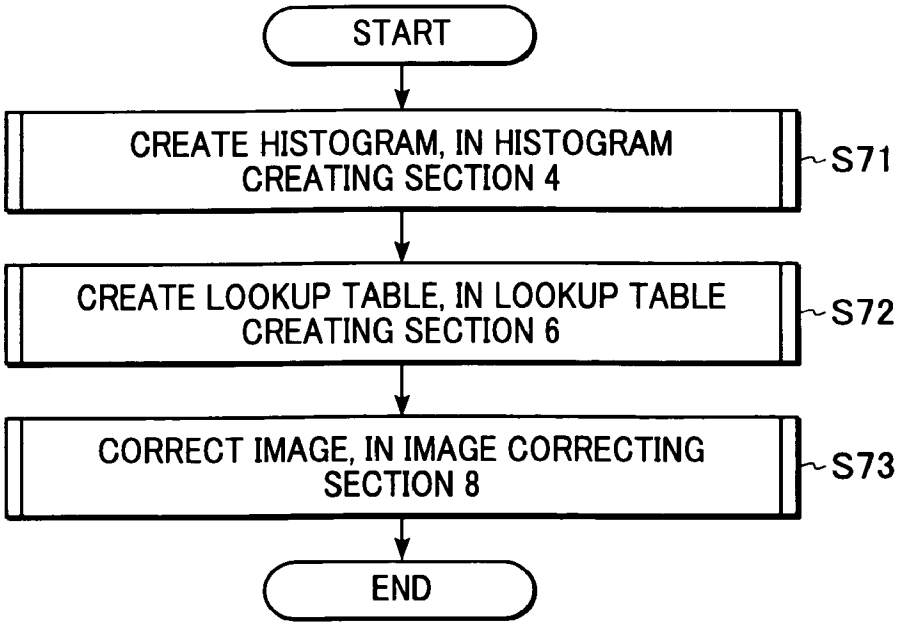

START
CREATE HISTOGRAM, IN HISTOGRAM CREATING SECTION 4
S71
CREATE LOOKUP TABLE, IN LOOKUP TABLE CREATING SECTION 6
S72
CORRECT IMAGE, IN IMAGE CORRECTING SECTION 8
S73
END

FIG. 15

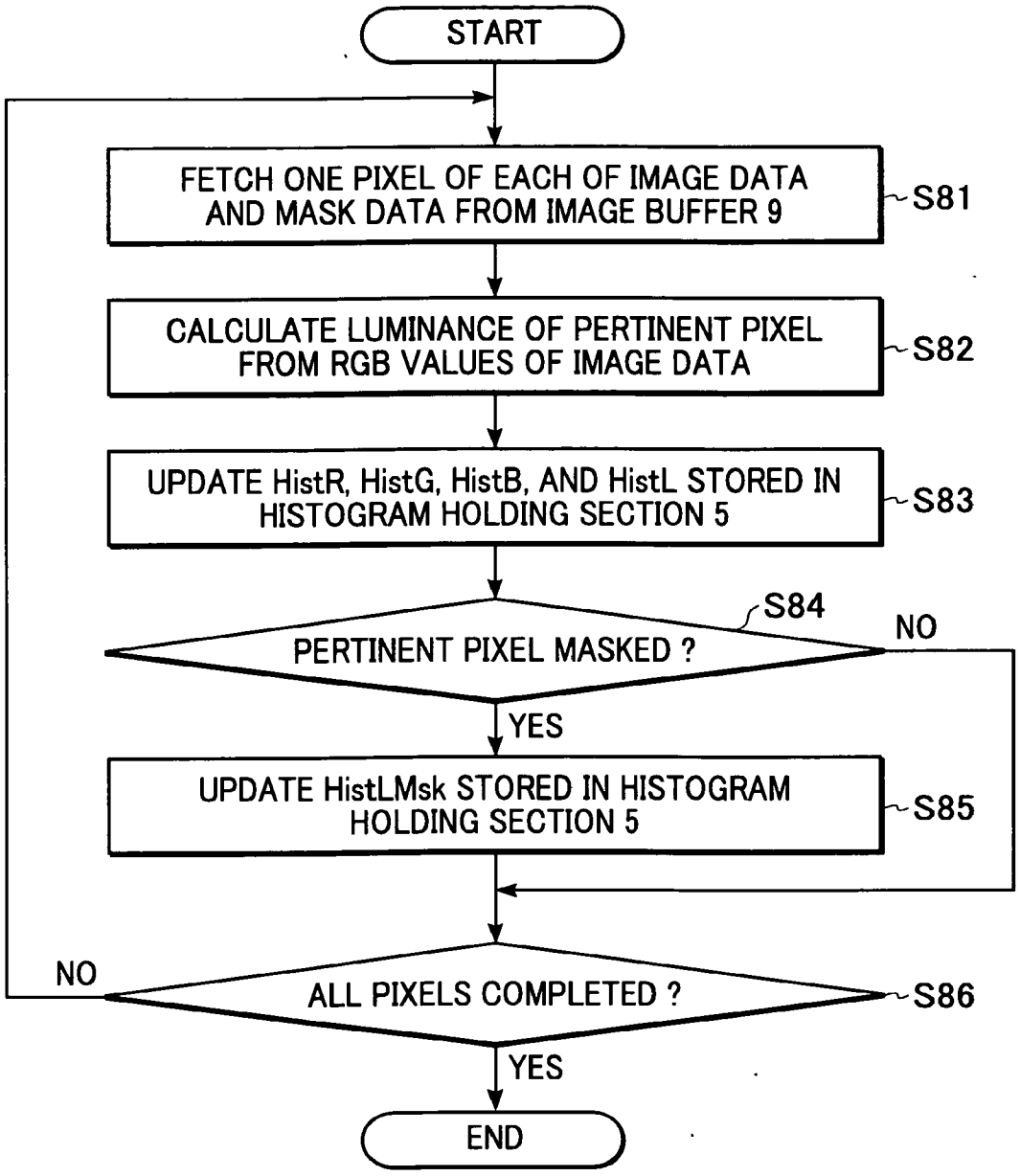

START
FETCH ONE PIXEL OF EACH OF IMAGE DATA AND MASK DATA FROM IMAGE BUFFER 9
S81
CALCULATE LUMINANCE OF PERTINENT PIXEL FROM RGB VALUES OF IMAGE DATA
S82
UPDATE HistR, HistG, HistB, AND HistL STORED IN HISTOGRAM HOLDING SECTION 5
S83
S84
PERTINENT PIXEL MASKED ?
NO
YES
UPDATE HistLMsk STORED IN HISTOGRAM HOLDING SECTION 5
S85
NO
ALL PIXELS COMPLETED ?
S86
YES
END

FIG. 16

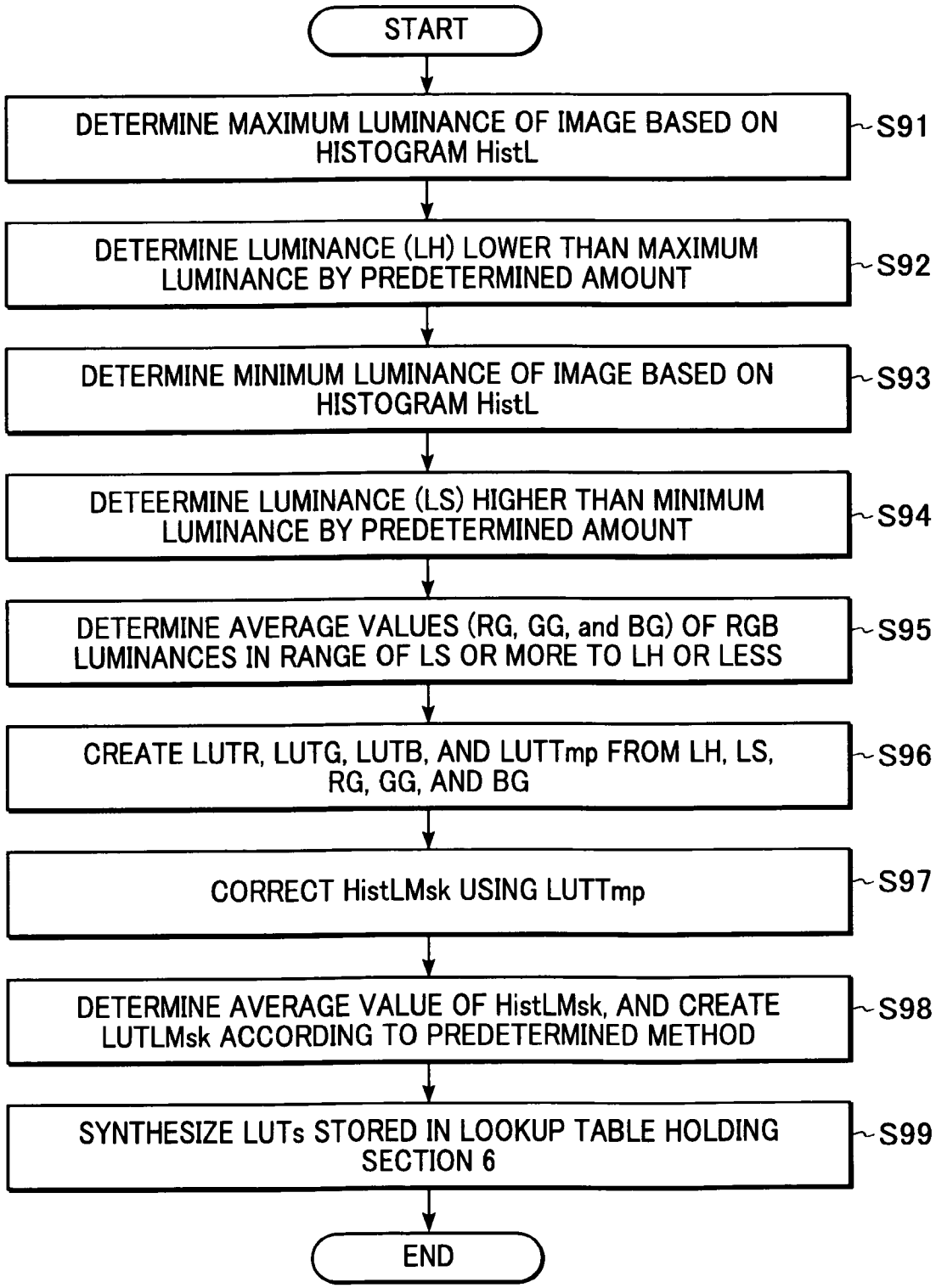

START
DETERMINE MAXIMUM LUMINANCE OF IMAGE BASED ON HISTOGRAM HistL
S91
DETERMINE LUMINANCE (LH) LOWER THAN MAXIMUM LUMINANCE BY PREDETERMINED AMOUNT
S92
DETERMINE MINIMUM LUMINANCE OF IMAGE BASED ON HISTOGRAM HistL
S93
DETEERMINE LUMINANCE (LS) HIGHER THAN MINIMUM LUMINANCE BY PREDETERMINED AMOUNT
S94
DETERMINE AVERAGE VALUES (RG, GG, and BG) OF RGB LUMINANCES IN RANGE OF LS OR MORE TO LH OR LESS
S95
CREATE LUTR, LUTG, LUTB, AND LUTTmp FROM LH, LS, RG, GG, AND BG
S96
CORRECT HistLMsk USING LUTTmp
S97
DETERMINE AVERAGE VALUE OF HistLMsk, AND CREATE LUTLMsk ACCORDING TO PREDETERMINED METHOD
S98
SYNTHESIZE LUTs STORED IN LOOKUP TABLE HOLDING SECTION 6
S99
END

FIG. 17A

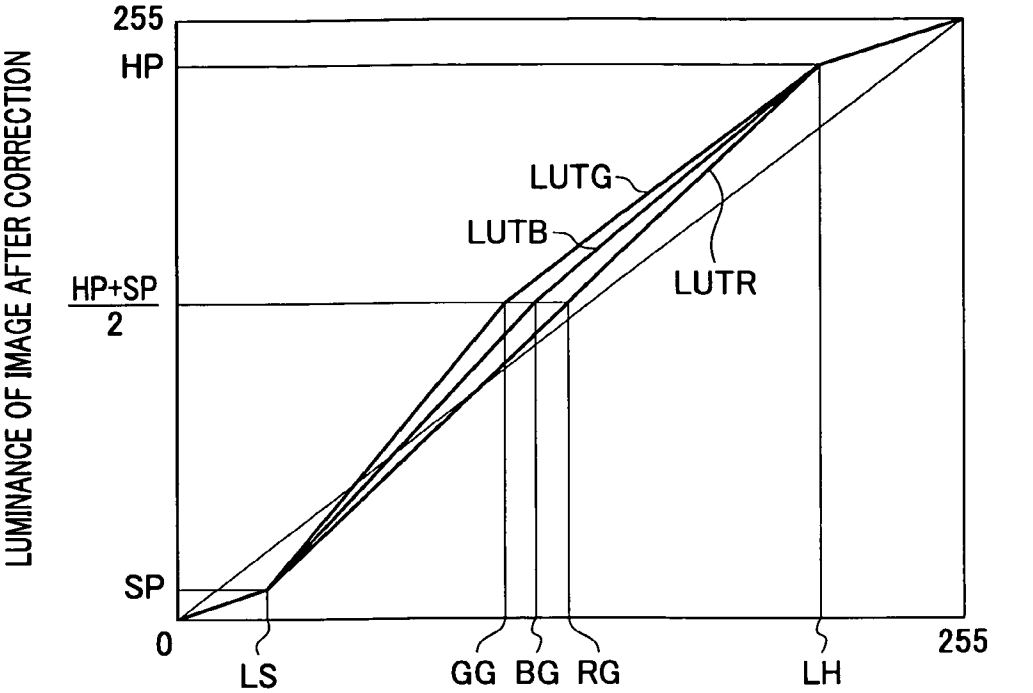


FIG. 17B

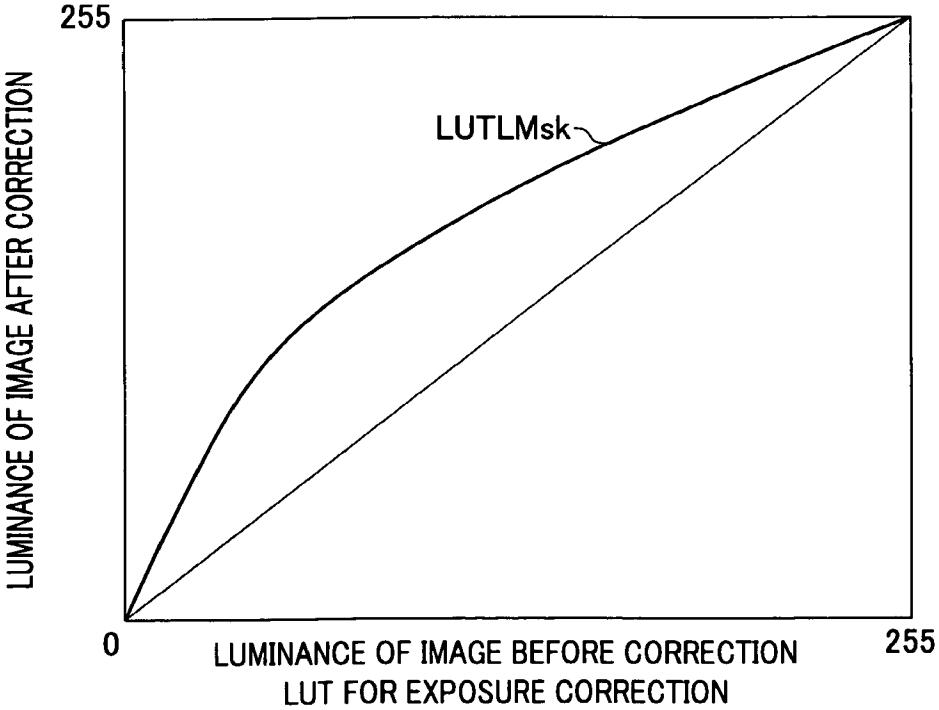


FIG. 18

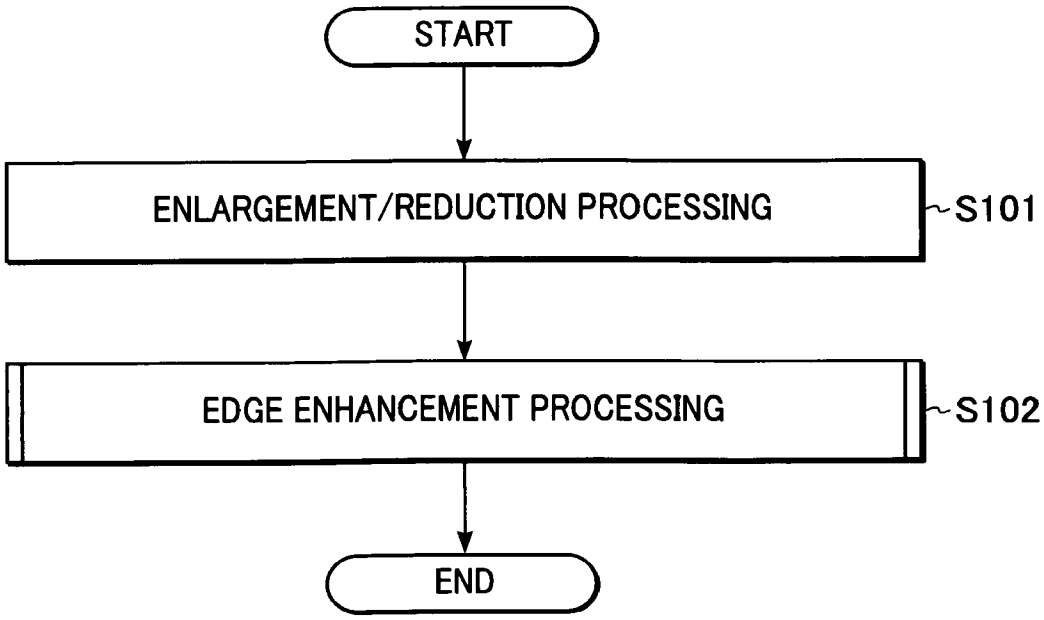

START
ENLARGEMENT/REDUCTION PROCESSING
S101
EDGE ENHANCEMENT PROCESSING
S102
END

FIG. 19

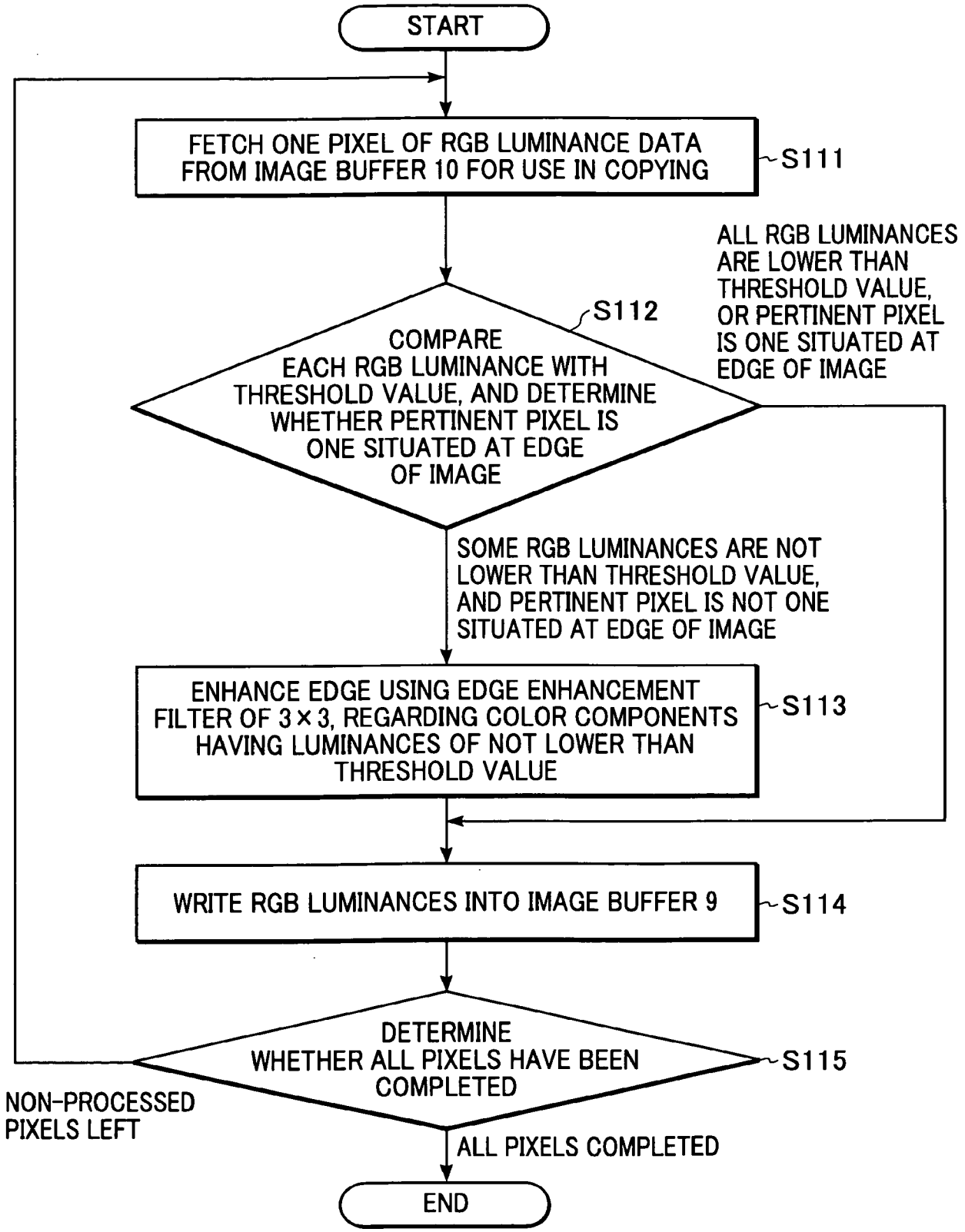
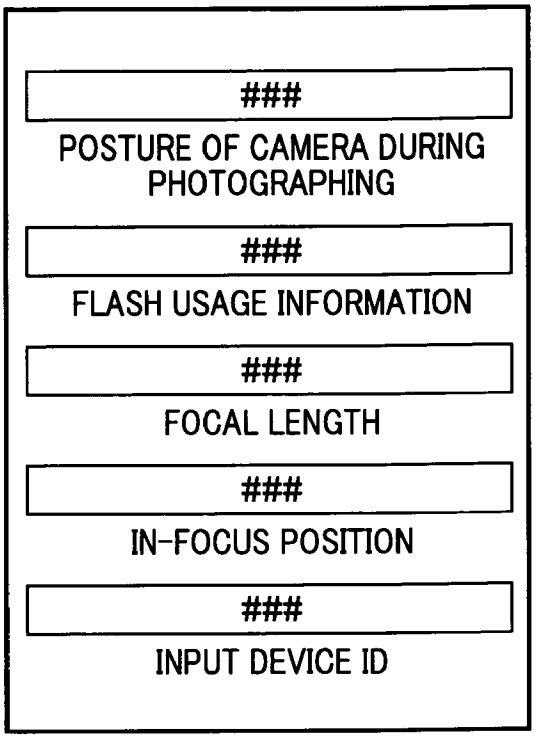

START
FETCH ONE PIXEL OF RGB LUMINANCE DATA FROM IMAGE BUFFER 10 FOR USE IN COPYING
S111
S112
COMPARE EACH RGB LUMINANCE WITH THRESHOLD VALUE, AND DETERMINE WHETHER PERTINENT PIXEL IS ONE SITUATED AT EDGE OF IMAGE
ALL RGB LUMINANCES ARE LOWER THAN THRESHOLD VALUE, OR PERTINENT PIXEL IS ONE SITUATED AT EDGE OF IMAGE
SOME RGB LUMINANCES ARE NOT LOWER THAN THRESHOLD VALUE, AND PERTINENT PIXEL IS NOT ONE SITUATED AT EDGE OF IMAGE
ENHANCE EDGE USING EDGE ENHANCEMENT FILTER OF 3 × 3, REGARDING COLOR COMPONENTS HAVING LUMINANCES OF NOT LOWER THAN THRESHOLD VALUE
S113
WRITE RGB LUMINANCES INTO IMAGE BUFFER 9
S114
DETERMINE WHETHER ALL PIXELS HAVE BEEN COMPLETED
S115
NON-PROCESSED PIXELS LEFT
ALL PIXELS COMPLETED
END

FIG. 20



PHOTOGRAPHING INFORMATION

PIXELS	R VALUES	G VALUES	B VALUES
IMG[0]	##	##	##
IMG[1]	##	##	##
IMG[2]	##	##	##
IMG[3]	##	##	##
IMG[4]	##	##	##
IMG[5]	##	##	##
IMG[6]	##	##	##
IMG[7]	##	##	##
:			
IMG[n]	##	##	##
:			

IMAGE DATA

FIG. 21

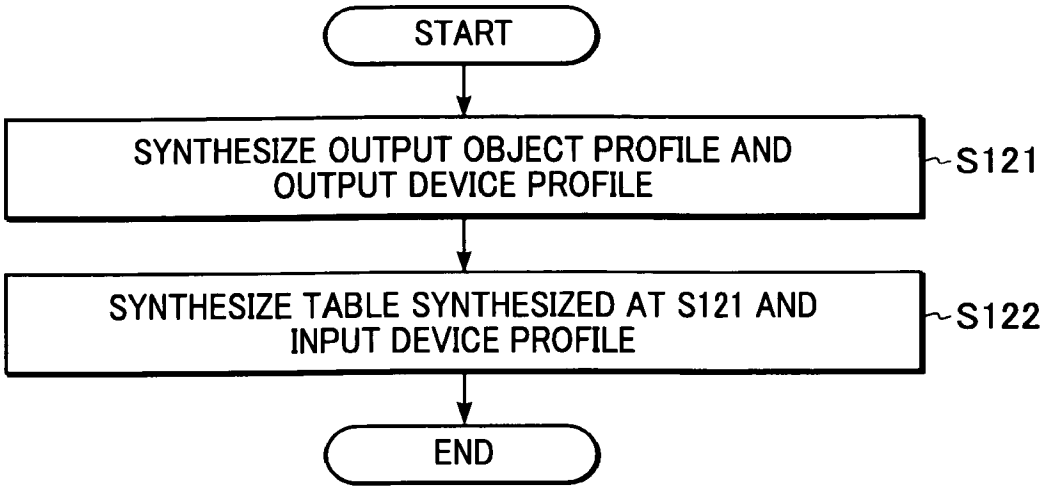

START
SYNTHESIZE OUTPUT OBJECT PROFILE AND OUTPUT DEVICE PROFILE
S121
SYNTHESIZE TABLE SYNTHESIZED AT S121 AND INPUT DEVICE PROFILE
S122
END

FIG. 22

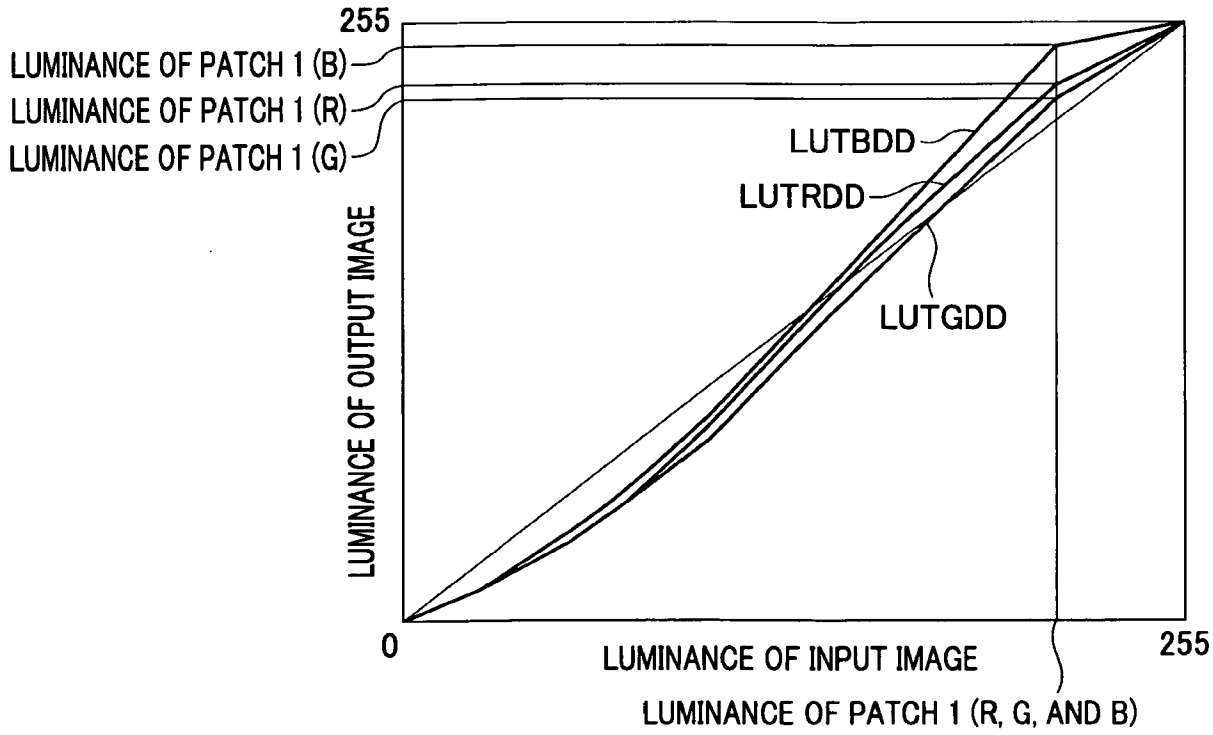

255
LUMINANCE OF PATCH 1 (B)
LUMINANCE OF PATCH 1 (R)
LUMINANCE OF PATCH 1 (G)
LUTBDD
LUTRDD
LUTGDD
LUMINANCE OF OUTPUT IMAGE
0
LUMINANCE OF INPUT IMAGE
255
LUMINANCE OF PATCH 1 (R, G, AND B)

FIG. 23

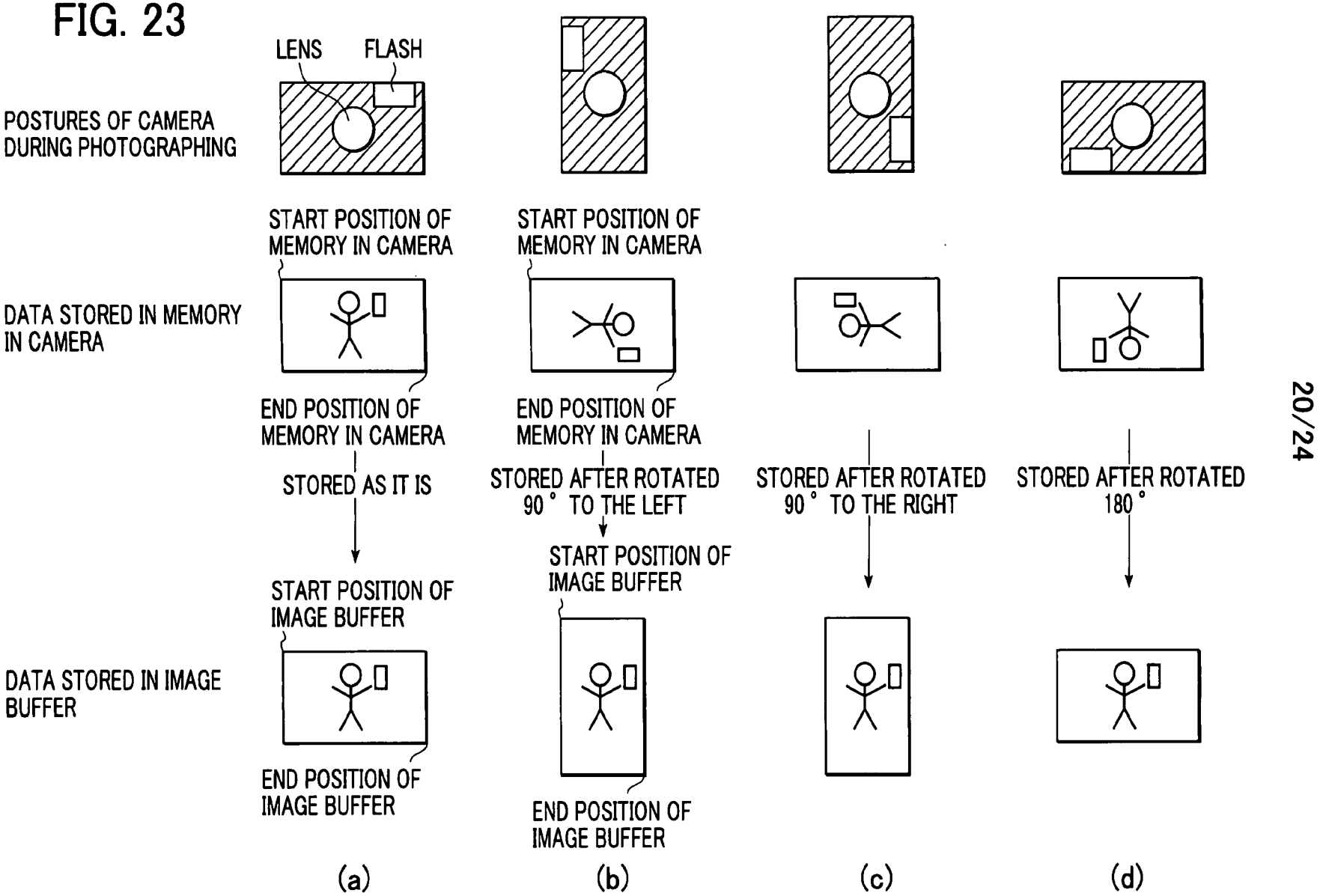

POSTURES OF CAMERA DURING PHOTOGRAPHING
LENS
FLASH
DATA STORED IN MEMORY IN CAMERA
START POSITION OF MEMORY IN CAMERA
END POSITION OF MEMORY IN CAMERA
STORED AS IT IS
STORED AFTER ROTATED 90 ° TO THE LEFT
STORED AFTER ROTATED 90 ° TO THE RIGHT
STORED AFTER ROTATED 180 °
START POSITION OF IMAGE BUFFER
DATA STORED IN IMAGE BUFFER
END POSITION OF IMAGE BUFFER
(a)
(b)
(c)
(d)

FIG. 24A

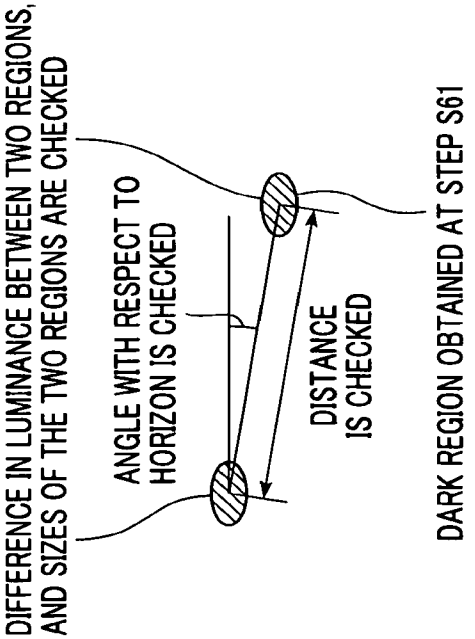


FIG. 24B

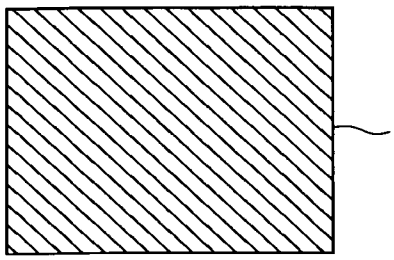


FIG. 24C

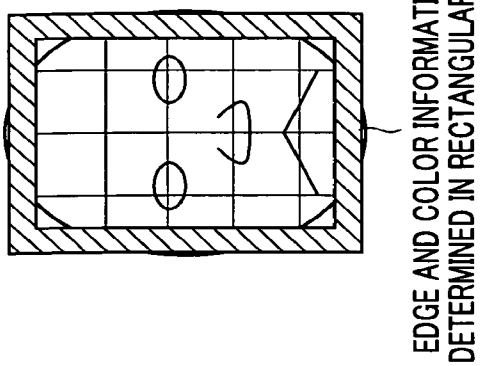


FIG. 25

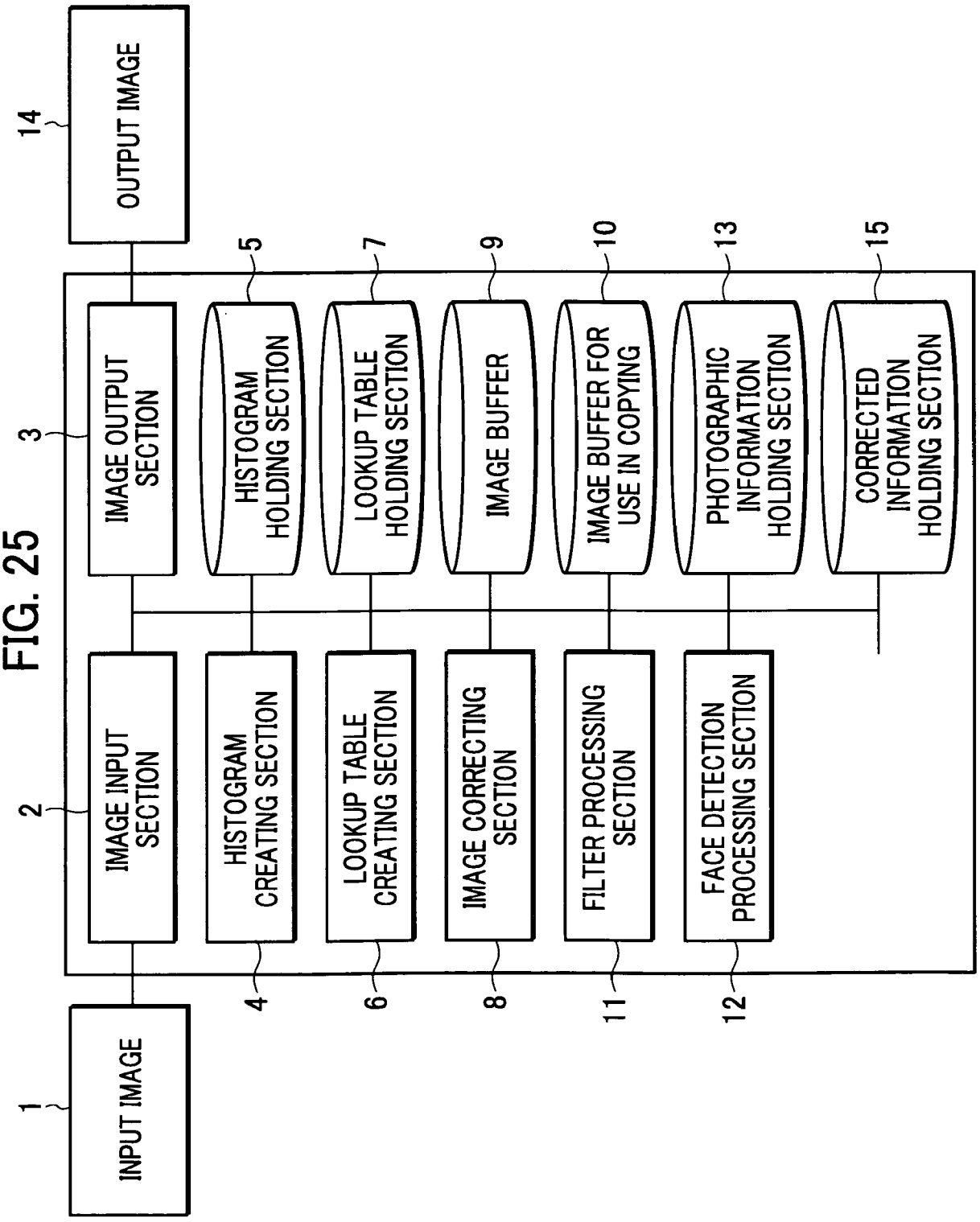

1
INPUT IMAGE
2
IMAGE INPUT SECTION
3
IMAGE OUTPUT SECTION
4
HISTOGRAM CREATING SECTION
5
HISTOGRAM HOLDING SECTION
6
LOOKUP TABLE CREATING SECTION
7
LOOKUP TABLE HOLDING SECTION
8
IMAGE CORRECTING SECTION
9
IMAGE BUFFER
10
IMAGE BUFFER FOR USE IN COPYING
11
FILTER PROCESSING SECTION
12
FACE DETECTION PROCESSING SECTION
13
PHOTOGRAPHIC INFORMATION HOLDING SECTION
14
OUTPUT IMAGE
15
CORRECTED INFORMATION HOLDING SECTION

FIG. 26

		IN-FOCUS POSITION		
		SHORT DISTANCE	INTERMEDIATE DISTANCE	LONG DISTANCE
FLASH	USED	HP = ## SP = ##	HP = ## SP = ##	HP = ## SP = ##
	NOT USED	HP = ## SP = ##	HP = ## SP = ##	HP = ## SP = ##

FIG. 27

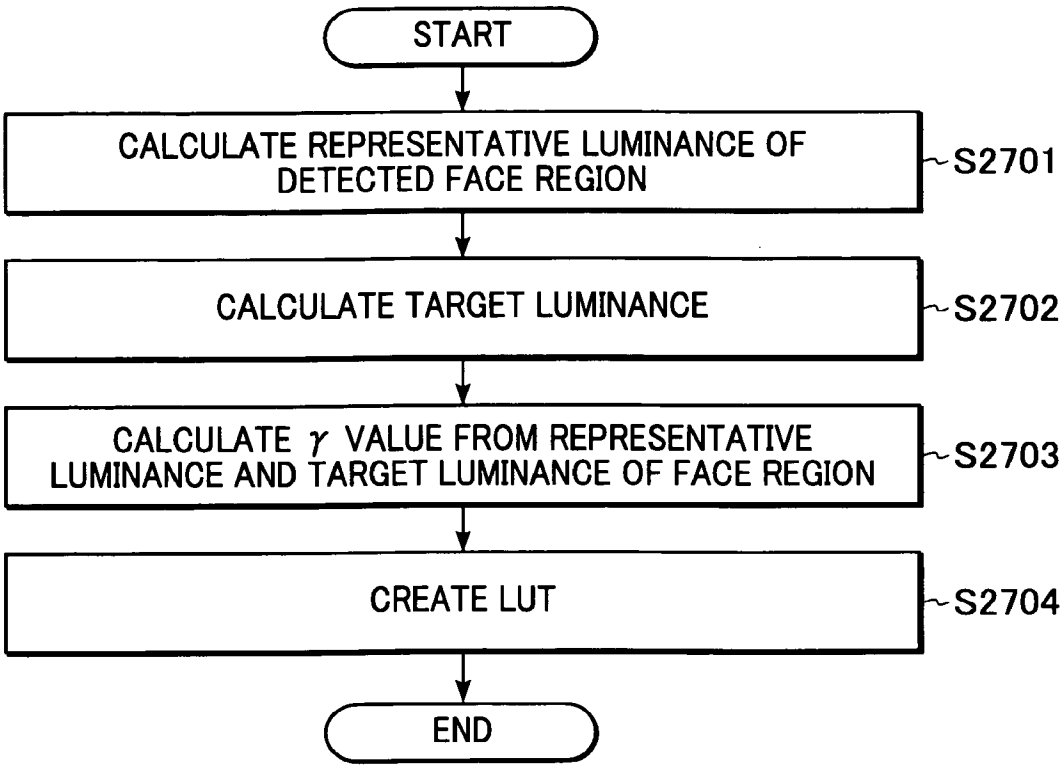
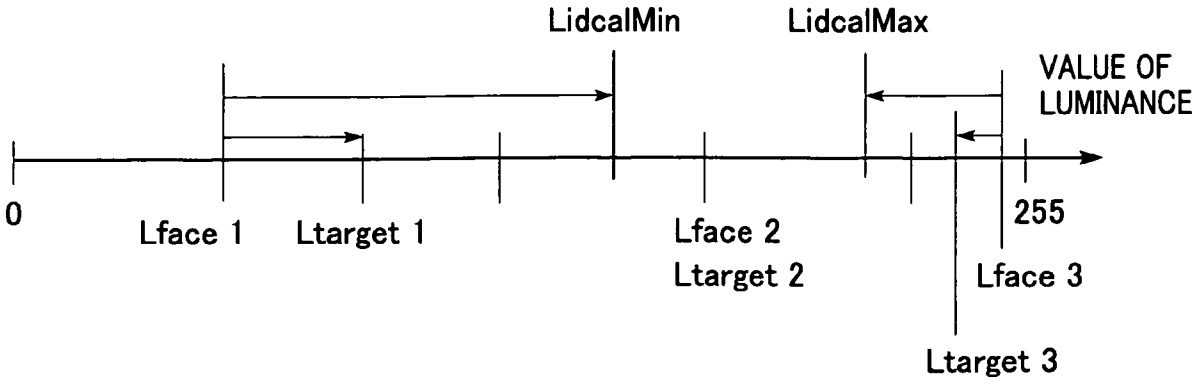

START
CALCULATE REPRESENTATIVE LUMINANCE OF DETECTED FACE REGION
S2701
CALCULATE TARGET LUMINANCE
S2702
CALCULATE γ VALUE FROM REPRESENTATIVE LUMINANCE AND TARGET LUMINANCE OF FACE REGION
S2703
CREATE LUT
S2704
END

FIG. 28


LidcalMin
LidcalMax
VALUE OF LUMINANCE
0
Lface 1
Ltarget 1
Lface 2
Ltarget 2
255
Lface 3
Ltarget 3